

AMENDMENTS TO THE CLAIMS

1. (Canceled)

2. (Currently Amended) A magnetic sensor which detects a magnetic field comprising: a plurality of magnetoresistance effect ~~element~~ elements, each comprising a spin valve film, the spin valve film comprising a free layer, a spacer layer and a pinned layer whose magnetization direction is pinned, wherein said layers are successively laminated on a substrate of a single chip, the substrate having a rectangular shape which has two sides along an X-axis and two sides along a Y-axis, the X-axis and the Y-axis being perpendicular to each other in a plan view, each of said magnetoresistance effect ~~element~~ elements having a resistance value that changes in accordance with a relative angle formed by the magnetization direction of the pinned layer and a magnetization direction of the free layer;

said magnetic sensor being formed in such a manner that [[a]] said plurality of said magnetoresistance effect elements are provided on a single plane, said plurality of said magnetoresistance effect elements are placed symmetrically with respect to center lines of the rectangular shape, one of the center lines is a center line of the two sides along the X-axis and perpendicular to the Y-axis and the other of the center lines is a center line of the two sides along the Y-axis and perpendicular to the X-axis, and the pinned layers of at least two of said plurality of magnetoresistance effect elements have [[the]] pinned magnetization directions that cross each other.

3. (Currently Amended) A [[The]] magnetic sensor ~~according to claim 2, wherein~~ comprising:

a plurality of magnetoresistance effect elements;

four of said plurality of magnetoresistance effect elements coupled to comprise [[:]] a single axis magnetic sensor by full bridge connection of the four elements, the single axis magnetic sensor being an X-axis magnetic sensor for detecting a magnetic field along [[the]]an X-axis or a Y-axis magnetic sensor for detecting a magnetic field along [[the]]an Y-axis,

each of the plurality of magnetoresistance effect elements comprising a spin valve film, the spin valve film comprising a free layer, a spacer layer, and a pinned layer whose magnetization direction is pinned, said pinned magnetization directions of the pinned layers of the four elements being parallel to each other, wherein said layers are successively laminated on a substrate of a single chip, the substrate having a rectangular shape which has two sides along the X-axis and two sides along the Y-axis, the X-axis and the Y-axis being perpendicular to each other in a plan view, each of said plurality of magnetoresistance effect elements having a resistance value that changes in accordance with a relative angle formed by the magnetization direction of the pinned layer and a magnetization direction of the free layer, and

wherein said magnetic sensor is formed in such a manner that said plurality of magnetoresistance effect elements are provided on a single plane, said magnetoresistance effect elements are placed symmetrically with respect to center lines of the rectangular shape, one of the center lines is a center line of the two sides along the X-axis and perpendicular to the Y-axis and the other of the center lines is a center line of the two sides along the Y-axis and perpendicular to the X-axis, and the pinned layers of at least two of said plurality of magnetoresistance effect elements have pinned magnetization directions that cross each other.

4. (Previously Presented) A magnetic sensor which detects a magnetic field comprising:

eight magnetoresistance effect elements including a first through an eighth element, each of said elements comprising a spin valve film, the film comprising a free layer, a spacer layer and a pinned layer, said pinned layer having a pinned magnetization direction, wherein said layers are successively laminated on a substrate of a single chip, the substrate having a rectangular shape which has a left side along a Y-axis, a right side along the Y-axis, a top side along an X-axis and a bottom side along the X-axis in a plan view, the X-axis and the Y-axis are perpendicular to each other, and each of the elements has a resistance value that changes in accordance with a relative angle formed by a magnetization direction of said pinned layer and a magnetization direction of said free layer;

said magnetic sensor being formed in such a manner that said magnetoresistance effect elements are provided on a single plane,

(a) said first element being formed at a position closer to the left side than the right side and below a first center line of the left side and the right side, the first center line being perpendicular to the Y-axis, and said first element, having a pinned magnetization direction of said first element's pinned layer in a direction of the X-axis;

(b) said second element being formed at a position closer to the left side than the right side and above the first center line, and said second element having a pinned magnetization direction of said second element's pinned layer in the direction of the X-axis;

(c) said third element being formed at a position closer to the right side than the left side and above the first center line, and said third element having a pinned magnetization direction of said third element's pinned layer in the direction of the X-axis;

(d) said fourth element being formed at a position closer to the right side than the left side and below the first center line, and said fourth element having a pinned magnetization direction of said fourth element's pinned layer in the direction of the X-axis;

(e) said fifth element being formed at a position closer to the top side than the bottom side and left of a second center line of the top side and the bottom side, the second center line being perpendicular to the X-axis, and said fifth element having a pinned magnetization direction of said fifth element's pinned layer in the direction of the Y-axis;

(f) said sixth element being formed at a position closer to the top side than the bottom side and right of the second center line, and said sixth element having a pinned magnetization direction of said sixth element's pinned layer in the direction of the Y-axis;

(g) said seventh element being formed at a position closer to the bottom side than the top side and right of the second center line, and said seventh element having a pinned magnetization direction of said seventh element's pinned layer in the direction of the Y-axis; and

(h) said eighth element being formed at a position closer to the bottom side than the top side and left of the second center line, and said eighth element having a pinned magnetization direction of said eighth element's pinned layer in the direction of the Y-axis.

5. (Previously Presented) The magnetic sensor according to claim 4 wherein:

(a) said first to fourth elements construct an X-axis magnetic sensor for detecting a magnetic field in the direction of the X-axis by full bridge connection of the first to fourth elements; and

(b) said fifth to eighth elements construct a Y-axis magnetic sensor for detecting a magnetic field in the direction of the Y-axis by full bridge connection of the fifth to eighth elements.

6. (Previously Presented) The magnetic sensor according to claim 5, wherein:

(a) the pinned magnetization direction of the pinned layer of the first and the second elements are in a negative direction of the X-axis;

(b) the pinned magnetization direction of the pinned layer of the third and the fourth elements are in a positive direction of the X-axis;

(c) the pinned magnetization direction of the pinned layer of the fifth and the sixth elements are in a positive direction of the Y-axis; and

(d) the pinned magnetization direction of the pinned layer of the seventh and the eighth elements are in a negative direction of the Y-axis.

7. (Canceled)

8. (Currently Amended) A magnetic sensor which detects a magnetic field comprising a plurality of magnetoresistance effect elements, each element comprising a spin valve film, the spin valve film comprising a free layer, a spacer layer and a pinned layer having a pinned magnetization direction, [[the]] each magnetoresistance effect element having a resistance value that changes in accordance with a relative angle formed by a magnetization direction of the pinned layer and a magnetization direction of the free layer, wherein:

(a) said layers of each of the magnetoresistance effect elements are successively laminated directly on a single substrate of a single chip;

(b) an X-axis group of four of a plurality of said magnetoresistance effect elements constructs a single X-axis magnetic sensor for detecting a magnetic field in an X-axis direction; and all of said magnetoresistance effect elements of the X-axis group have pinned magnetization

directions of the pinned layers parallel to each other, said X-axis group of magnetoresistance effect elements construct the X-axis magnetic sensor by full bridge connection, and the pinned magnetization directions of the X-axis group of magnetoresistance effect elements are in the X-axis direction; and

(c) a Y-axis group of four of a plurality said magnetoresistance effect elements constructs a single Y-axis magnetic sensor for detecting a magnetic field in a Y-axis direction perpendicular to the X-axis direction and all of said magnetoresistance effect elements of the Y-axis group have pinned magnetization directions of the pinned layers parallel to each other, said Y-axis group of magnetoresistance effect elements construct the Y-axis magnetic sensor by full bridge connection, and the pinned magnetization directions of the Y-axis group of magnetoresistance effect elements are in the Y-axis direction.

9-17. (Canceled)

18. (Previously Presented) The magnetic sensor according to claim 8 wherein said Y-axis sensor is disposed within an area defined by said X-axis sensor.

19. (New) A magnetic sensor comprising:

a plurality of magnetoresistance effect elements, each of the plurality of magnetoresistance effect elements comprising a spin valve film, the spin valve film comprising a free layer, a spacer layer, and a pinned layer whose magnetization direction is pinned, wherein said layers are successively laminated on a substrate of a single chip, the substrate having a rectangular shape which has two sides along an X-axis and two sides along a Y-axis, the X-axis and the Y-axis being perpendicular to each other in a plan view, each of said plurality of magnetoresistance effect elements having a resistance value that changes in accordance with a relative angle formed by the magnetization direction of the pinned layer and a magnetization direction of the free layer,

wherein said plurality of magnetoresistance effect elements are provided on a single plane, said magnetoresistance effect elements are placed symmetrically with respect to center lines of the rectangular shape, one of the center lines is a center line of the two sides along the X-axis and perpendicular to the Y-axis and the other of the center lines is a center line of the two sides

along the Y-axis and perpendicular to the X-axis, and the pinned layers of at least two of said plurality of magnetoresistance effect elements have pinned magnetization directions that cross each other

four of said plurality of magnetoresistance effect elements being coupled to comprise a single axis magnetic sensor by full bridge connection of the four elements, the single axis magnetic sensor being:

- an X-axis magnetic sensor for detecting a magnetic field along the X-axis, wherein said pinned magnetization directions of the pinned layers of the four elements are parallel to each other and anti-parallel between two of the four elements placed symmetrically with respect to the center line of the two sides along the Y-axis and perpendicular to the X-axis, or
- a Y-axis magnetic sensor for detecting a magnetic field along the Y-axis, wherein said pinned magnetization directions of the pinned layers of the four elements are parallel to each other and anti-parallel between two of the four elements placed symmetrically with respect to the center line of the two sides along the X-axis and perpendicular to the Y-axis.